



THINKING LOCALLY: A subsidiary centred model of FDI- related spillovers

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ABSTRACT

Governments in developing (and developed) countries spend large sums to attract foreign companies (e.g. \$300,000 per job created in Brazil). But there is only one welfare justification for subsidizing MNCs: that they generate spillover effects. Yet, most of the empirical literature has not identified the expected spillovers or explained why they do not appear to occur (Smeets, 2008, Jarovick, 2004). I argue that this is because of a mismatch between the key assumptions underlying the conventional model used to estimate spillover effects and recent theorizing about how MNCs operate. Then, I propose an alternative approach. In this alternative the accumulation of technological assets and capacities by MNC' subsidiaries in the host economy, is the main driver of spillover effects in association with FDI. This contrasts with conventional approaches which presume that spillovers arise exclusively in association with technological assets created by MNC's in central locations. The paper summarises the empirical evidence in support of the alternative model proposed here and outlines some of the key theoretical and policy implications of this new way of conceptualizing spill over effects.

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1. Introduction

After decades of restricting foreign direct investment (FDI), governments in developing countries are now falling over themselves to attract external investors, spending large sums of money to attract foreign companies. In Brazil, for example, competition to attract FDI is estimated to have cost around US\$300,000 per job created (Oman, 2000). These efforts are justified because multinational corporations (MNCs) are thought to bring not just employment and capital, but also new skills and technological knowledge for domestic firms. Such benefits are supposed to leak out from MNC subsidiaries to domestic firms as 'spillovers'. But the empirical evidence to support the positive spillover effects expected by both policymakers and theorists is contradictory and inconclusive (see Jarovick, 2004 for a discussion of the empirical literature and Crespo and Fontoura, 2006 for a survey).

The contrast between expectations and evidence has been well summarized by Rodrik (1999). He notes that “today’s policy literature is filled with extravagant claims about positive spillovers from FDI”, but then stresses that “the evidence is sobering” (Rodrik, 1999, p605). In this paper I argue that this contrast between expectations and evidence can be explained by a mismatch between the key assumptions underlying the conventional model used to explore FD- related spillovers and recent theorizing about how MNCs operate. Then, I propose an alternative model based in part on the more recent theoretical literature on MNCs..

The conventional model used to explore FD- related spillovers rests on three key assumptions about how MNCs operate: first, that MNCs possess and exploit technological assets – an ownership advantage seen as the main reason for the MNC’s existence; second, that knowledge is a kind of ‘public good’ within MNCs, ie, it is mobile, and has a joint character within firms and; third, that the MNC is a tightly integrated organisation, with the behaviour of subsidiaries closely shaped by central strategies and decisions. These conditions provide the basis for a ‘*pipeline model*’ in

which spillovers of superior technology are delivered from MNCs to subsidiaries, whence they 'leak' to domestic firms without subsidiaries playing any important active role. When empirical evidence is weak, it is argued that the lack of spillovers is due to either the limited capabilities of locally owned firms to absorb potential spillovers (Konings, 2001; Kokko, 1994; Girma, 2005) or the strategies of MNCs about what is transferred to subsidiaries (Narula and Dunning, 2000; Wang and Blomstrom, 1992; Driffield and Love 2007).

But recent theorizing about MNCs in the international business literature questions whether MNC advantages emerge exclusively from unique technological assets created by parent companies in central locations. Instead, it is argued they are associated with the capacity of MNCs to manage international networks of differentiated knowledge activities carried out by subsidiaries in different locations. (Cantwell, 1995; Birkinshaw *et al*, 1998; Kogut, 2002). Subsidiaries are thus included into MNC' models as active player in the process of knowledge creation within MNCs. Also, technology transfer depends on – among other things - subsidiaries' absorptive capabilities (Teece, 1977; Sulansky, 1996) it is argued. Consequently subsidiaries are seen as active players for knowledge diffusion *within* MNCs.

Accordingly in this paper I propose an alternative model of spillovers generation. In this alternative, which I refer as *a subsidiary-centred model of spillover* effects a substantial part of the technological potential for spillover effects in association with FDI is seen as arising within the local subsidiary by its own knowledge-creating activities in the host country, rather than being delivered to it from the parent company. These activities are expected to affect (1) the capacity of subsidiaries to absorb the superior technology available within the MNC network and then, the potential to diffuse this knowledge and, (2) the capacity of subsidiaries to create new knowledge in the host economy, which can then leak out to domestic firms. I summarise the empirical evidence in support of the alternative model proposed here and outline some of the key theoretical and policy implications of this new way of conceptualizing spillover effects. In particular, I discuss a number of new directions of research which are open up by such a framework.

The paper is organized as follow. Section 2 examines the conventional views about the mechanisms underlying FDI-related spillover effects, it discusses its problems and the evidence. Section 3 explores the significance of the alternative model proposed here. With this purpose the paper discusses two sets of issues. First, it discusses the growing importance of subsidiaries within MNC theory – in association with the growing influence of more flexible perspectives on the MNC. Second it discusses new emerging empirical evidence supporting the importance of this model to explain the existence and degree of spillovers. Finally, section 4 discusses theoretical and policy implications of this alternative model.

2. A Pipeline model of FDI-Related Spillovers

For the purpose of the analysis in this section, all mechanisms and agents involved in the process of spillover generation are separated into two main types: those coming from the *supply side*, or source of spillover, when they are related to the actions taken by MNCs and their foreign plants, and those coming from the *demand side*, or the recipient units of spillovers effects, when they are related to actions taken by the domestic firms,.

2.1 The pioneer studies: origins of the current perspective on FDI-related spillovers

MacDougall (1960) was one of the first authors who, using a neo-classical framework, explicitly analysed potential benefits and costs associated with FDI in host economies. To do so, he used an aggregate production function with only two inputs – labour and a homogeneous stock of capital – and assumed full employment and perfect competition. Thus, applying the conventional tools of economic analysis the main changes he predicted were: an increase in final output, a redistribution of incomes favouring workers², and higher taxes³. The possibility for external effects – or spillovers- emerged

² With L constant, an increase in (homogeneous) capital will increase the K/L relationship and consequently the Marginal Product of labour and wages.

³ Higher tax revenues from foreign profits – if the higher investment it is not induced by lower tax rates.

in his model, but only after the assumptions of perfect competition and constant returns to scale were removed⁴.

MacDougall was the first author that introduced the idea of external economies associated with FDI. He defined external economies as the difference between added-value to output (generated by the extra capital) and profits (before taxes), and he argued that when positive, they could be explained by any of the following situations⁵:

- ?? The breaking of bottlenecks;
- ?? The introduction of know-how by foreign firms (when technical and administrative knowledge gets outside the foreign firms); and/or
- ?? The training of workers who may later be employed by local firms.

According to MacDougall these effects were possible because of the different levels of efficiency between foreign and local firms. Specifically, he argued that, the greater the differences in efficiency between foreign and domestic firms the higher the increases in local output arising from the leaking out of the MNCs' superior efficiency.

Unfortunately, MacDougall (1960) did not expand on this idea further. In particular, he did not make it clear whether the differences in efficiency between firms originated in differences in factor intensities (larger K/L) or output scale, with the production function given, or in differences in the possession of non-conventional factors (such as technology). While in the second case the potential for technology effects is unambiguous, in the first case it is clearly minimised, because the differences in efficiency can be transferred to prices and the competition in markets will eliminate them in the long term⁶.

⁴ He also showed that the effects of extra FDI on the terms of trade are unlikely to be large, and that the impact over the balance of payment can be more important and dangerous. This will depend on the relationship between inflow of capital and payments of profits abroad, and the character of the extra production generated by the new FDI.

⁵ The author also discussed possible negative residual (losses) when the economies are biased towards labour savings rather than capital saving techniques.

⁶ Indeed, in a neo-classical framework, where differences in efficiency are explained purely by differences in factor intensities or output scale, the potential for benefits from FDI are limited to gains by taxation (Findlay, 1978).

The next generation of studies concentrated on and developed this idea much further. These studies, whose views are still dominant in many respects today, claimed that the potential for benefits in association with FDI emerges from an intrinsic advantage of foreign over domestic firms. Furthermore, for these studies MNCs' possession of some specific non-conventional factors of production (such as technology or skills), constitute the main explanation of this advantage, instead of different capital intensity – as in the neoclassical world. These ideas were based on Hymer's (1960) dissertation.

Hymer's dissertation (1960) first introduced the now very common idea that FDI is not only about the transfer of capital but also about the transfer of a "package" in which capital, management and new technology all are combined. He identified two main reasons for foreign direct investment:

- 1) The possession of some kind of innovative, cost, financial or marketing advantages (which must be sufficient to outweigh the disadvantages faced by MNCs to compete with indigenous firms in a foreign market)⁷; and
- 2) The need to control production and marketing operations in different national markets in order to appropriate fully the potential returns on the corporate assets of skill and knowledge,

Caves (1974) and then Findlay (1978), two classical studies in the field of technological spillovers from FDI, adopted this view of MNCs and FDI. In line with Hymer, they saw the MNC as a firm in possession of unique intangible assets, which uses FDI as a way of transferring these assets to different markets and capturing their full rents. The main benefits from FDI to the host country would thus derive from the combination of two elements: 1) the 'technological' superiority of MNC subsidiaries because of the possession of these technology assets, and, 2) the existence of contagious or

⁷ This is because MNCs are very likely to have some disadvantages when compared with domestic firms already operating in the host country. These disadvantages include cultural and language barriers, lack of knowledge of the local economy, customers, law, suppliers, being outside the local business and government network, communication and transport costs, and exchange risks, among others (Dunning, 1994; Markusen, 1995; Markusen and Maskus, 1999).

demonstration effects that create the potential for technology diffusion and productivity (or other) gains in domestic agents. In the words of Caves (1974):

“.....for product technology at least, the transfer is a central activity of MNCs. Diffusion from the subsidiary to its domestic competitors thus might bring new technology into the latter’s hands faster than otherwise, due either to the chance to view a novelty close at hand or to its competitive threat to markets...” (p184).

Based on this idea, first Caves (1974) and then Globerman (1979) pioneered the empirical literature on technological spillovers from FDI. These authors dealt with the effects from FDI in what has come today to be the most popular way of studying FDI effects on host industrialising regions: associating domestic labour productivity and inter-industry differences with the share of the market occupied by foreign firms. In this way they identified positive spillover effects in Australia and Canada.

Based on similar ideas, Findlay (1978) was much more ambitious than Caves (1974). He meant to explain the rate of technological change in backward regions as a function of, among other things, the degree to which they are exposed to foreign capital. More specifically, he modeled technological change in backward regions as a function of two factors, which according to him would have a positive effect on technological change in backward regions: a) the differences in efficiency (or level of technology) between backward and developed regions’ firms or technology gap, and b) the proportion of foreign to domestic capital in the backward region⁸.

⁸ Findlay (1978) put forward three ideas to support his hypotheses. First, following Hymer (1960), he argued that foreign and domestic “capital” are essentially different (and their rates of return therefore do not need to equalise). Second, he saw these differences between the two types of firm – the technological distance or gap – as measuring the backlog of available opportunities for the domestic firms. On this basis, he then argued that the greater the distance between firms (and countries implicitly), the greater the pressure for change within the backward region, and so the rate of technological progress. Third, based on Mansfield (1961, 1968) he believed that the spread of innovations within an industry would increase with the proportion of firms in the industry that had already adopted the innovation. So, implicitly assuming MNCs carry with them new technologies, he argued that the larger the presence of MNCs, the greater the rate of technological change in the backward region – because of the existence of contagious effects.

Although the ideas of Caves and Findlay have been the object of a great deal of criticism recently in relation to their assumptions with respect to the *demand side*, their ideas have continued to under-pin the analysis regarding the 'supply side'.

2.2 The current perspective on the supply side: A centrally driven supply side model of spillover effects

Following these pioneer ideas, in the last 20 years or so there has been a great deal of work on FDI-related technological spillovers in host economies (eg, Blomstrom and Person, 1983; Blomstrom, 1986; Haddad and Harrison, 1993; Blomstrom and Sjöholm, 1999; and Haskel, Pereira and Slaughter, 2002; Javorcik, 2004; Girma, 2005; Javorcik and Spatareanu, 2008). However, the underlying view about the working of the process on the *supply side* in these studies has remained largely unchanged with respect to the ideas developed in the pioneer studies. This view rests on three main elements:

First, MNCs exist in the first place because they have come to possess unique knowledge assets that provide potential competitive advantages across a diversity of national markets, and because foreign direct investment is the most efficient means of exploiting those advantages compared to alternatives such as exports or licensing.

Second, it is implicitly assumed that knowledge is a kind of 'public good' within MNCs, a view that reflects neo-classical theoretical perspectives on the MNC, such as the knowledge capital model⁹. According to this view, technological knowledge is mobile and has a joint character within firms, i.e. can be easily moved across different departments and branches within the MNC, or from headquarters to local subsidiaries.

Third, MNC is typically seen as a single unit of analysis. The parent corporation and its subsidiaries are viewed as being bundled together as a tightly integrated organizational

⁹ This kind of perspective of the MNC has been formally developed by Markusen (1995) who argues that technological knowledge within firms can "*be transferred easily back and forth across space at low cost between units, and has a joint character, like a public good, in that it can be supplied to additional production facilities at very low cost*" (Markusen, 1995, p174).

entity within which knowledge assets are created, and decisions made about their exploitation, exclusively by the parent at the centre.

The presumed technological superiority of subsidiaries relative to domestic firms in the same industry in host economies is, thus, simply a reflection of the technological assets accumulated by the parent at the centre of the corporation. Spillovers from MNCs to domestic firms are presumed to follow on almost inevitably from the centrally driven technological advantage of the corporation in one or both of two ways:

- (a) the knowledge initially transferred from the parent diffuses from the subsidiary and is captured as an externality by domestic firms: (i) via the movement of highly skilled staff from subsidiaries to domestic firms; (ii) via demonstration effects involving the domestic firms' observation and imitation of the superior technology in subsidiaries; and/or (iii) via purposeful (but not market-mediated) transfers of knowledge from subsidiaries to local firms;
- (b) the subsidiary's superior performance derived from its transfer-delivered technology brings greater competitive pressure to bear on domestic firms that are induced to respond by generating their own technological change, or to exit the market, if upgrading is not achieved.

I refer to this perspective as a '*centrally-driven model*' or '*pipeline model*' of the process of spillover generation.

The working of the main mechanisms underlying spillover effects discussed in this section has been summarized recently by two of the most prolific contributors to the empirical analysis of FDI-related spillovers:

"It is well known that multinational corporations undertake a major part of the world's private R&D efforts and produce, own and control most of the world's advanced technology. When a MNC sets up a foreign affiliates, the affiliate receives some of the proprietary technology that constitutes the parent's firm-

specific advantage and allows it to compete successfully in an environment where local firms have superior knowledge of local markets, consumer preferences and business practices. This leads to a geographical diffusion of technology, but not necessarily to any formal transfer of technology beyond the boundaries of the MNC. The establishment of a foreign affiliate is, almost per definition a decision to internalise the use of core technology. However, MNC technology may still leak to the surrounding economy through external effects or spillovers that raise the level of human capital in the host country and increase productivity in local firms”
(Blomstrom and Kokko, 2003, p 3)

The empirical models to investigate the technology effects from FDI have been considerably extended and refined since the approaches pioneered by Caves (1974) and Globerman (1979). However the basic approach has remained fundamentally similar: measures of FDI participation (or MNCs presence) are related to measures of productivity growth in domestic firms that enjoy some point of contact with the foreign firms – which can be competitors, suppliers or clients. When the association is positive, FDI is claimed to have generated technology externalities. This type of formulation assumes three things:

- 1) The output differences that cannot be attributed to the accumulation of any input (conventional input) – the Solow residual – can be conceived as technological progress.
- 2) The level of productivity achieved by firms depends not only on its own “research” efforts, but also on the pool of general knowledge accessible to it.
- 3) FDI – similar to R&D – directly augments the domestically available stock of knowledge in its economic space.

There are several difficulties with the empirical evidence that has been generated using this methodology. The first is about the specification and empirical measurement of the supposed spillovers. As noted earlier, these are usually presumed to arise in one or both of two ways. First, the knowledge initially transferred from the parent diffuses from the subsidiary via various channels and is captured as an externality by domestic firms.

Second, the subsidiary's superior performance brings greater competitive pressure to bear on domestic firms, which are induced to respond by generating their own technological change.

These, however, are very different mechanisms. The first is about the diffusion of knowledge from MNC subsidiaries, but the second may not be about that at all, since local firms may be induced by competition to acquire new technology from sources other than the competition-generating MNCs. To some unknown extent, therefore, the second type of productivity gain constitutes a '*pseudo spillover*'. However, the separate roles of these two mechanisms are very rarely distinguished and the productivity gains from the combined effects are typically ascribed together to 'spillovers'.¹⁰ Consequently common estimation methods that do not consider this second ('pseudo') effect separately may over-state the magnitude of 'genuine' spillovers that are generated by FDI-driven international knowledge diffusion, or under-estimate the effects if, as pointed out by Aitken and Harrison (1999) competition effects from FDI reduce the productivity of some domestic firms¹¹.

The second difficulty about the available empirical evidence is simply that it does not indicate the widespread and significant existence of spillovers that one would expect from the underlying model. (for a comprehensive recent review see Crespo and Fontoura 2006 and Smeets, 2008). Early studies using cross section and industry data provided in general positive effects. More recent studies however using firm level data and panel data analysis have failed to provide convincing evidence of positive effects, particularly if the host countries are developing. This is the case both when the estimations are (a) restricted to horizontal spillovers, and (b) when they are inter-industry or vertical.¹²

¹⁰ Some exceptions are Chung (2001), Sjöholm (1999), Crespi et al (2007), Chang and Xu (2008) and Tian (2007).

¹¹ This might happen if MNCs have lower marginal costs and attract demand away from domestic firms or increase domestic wages.

¹² As a way of an example, from the 60 studies reviewed by Crespo and Fontouro (2006) only 12 identified positive effects, 12 found negative effects, and 31 cases found insignificant effects.

Consequently research attention has started to shift to ask why the assumed technological superiority of MNCs and their subsidiaries does not appear to diffuse to domestic firms. Specifically, three types of issue have been analyzed by the literature as possible explanations for the absence of technology spillovers:

- 1) Issues on the demand side of spillovers – in particular:
 - a. The absorptive capability of domestic firms which explains their capacity of taking advantage of the superior technologies introduced by MNCs (Kokko, 1994; Castellani and Zanfei, 2003; Girma, 2005);
 - b. The backwardness of domestic firms which explains the existing opportunities to take advantage from the superior technology of MNCs (Griffith, Redding and Simpson, 2002; Castellani and Zanfei, 2003; Peri and Urban, 2006);
- 2) Issues on the supply side of spillovers – in particular:
 - a. Inherent differences in the technological characteristics of the different (broadly defined) industries in which MNC subsidiaries are located (Kanturia, 2000, 2001; Buckley, Clegg and Wang, 2006; Kokko, 1994);
 - b. Intra-industry differences in the type and level of technologies transferred by the corporation as a result of its strategy (Wang and Blomstrom, 1992; Banga, 2003; Braconier, Ekholm and Midelfart-Knarvik, 2001; Javorcik and Spatareanu, 2008; Girma, 2003; Driffield and Love, 2006)
- 3) Others:
 - a. Characteristics of the host economies such as: differences in trade regimes or IPR regimes (Kokko, Tansini and Zejan, 1996; Feinberg and Majumdar, 2001)
 - b. Characteristics of domestic firms others than technology capacity or backwardness such as export orientation and size (Barrios and Strobl, 2002; Schoors and van der Tol, 2002; Aitken and Harrison, 1999)

The exploration of issues under (3) above has not yet been systematic. Arguments and evidence are case specific, and there is not a clear theoretical framework providing substance for them. In the next two sections therefore I concentrate on the other two types of study addressing the issues under (1) and (2). These two sets of issues have received

much more attention in the literature and there have been more systematic efforts to explore them. Nevertheless, as I will show, these efforts have neither led to questioning the centrally driven supply-side model underlying the analysis of FDI-related spillovers, nor helped to solve the problem of the inconclusive empirical evidence.

2.2 Issues on the Demand Side: The Influence of the Absorptive Capabilities of Domestic Firms

Within the *centrally driven supply-side* framework and its core assumptions, reasons for the absence of spillovers in host economies are logically seen as lying in the inability of domestic firms to absorb the superior knowledge and skills that MNCs deliver to their subsidiaries (see for example, Kokko, 1994; Konings, 2001; Kinoshita, 2001; Patibandla and Sanyal, 2005; Girma, 2005). Since a necessary condition for the existence of MNC subsidiaries is their ownership of superior technology, and since that technology has some of the characteristics of a public good, it is argued that the absence of technology spillovers can only be explained by the inability of domestic firms to absorb the superior knowledge that must, in principle, be locally available.

The main logic of this perspective is as follows: although FDI contributes to the enhancement of the domestic available pool of technological knowledge, domestic recipients will not be able to take advantage of this publicly available knowledge, unless they have the necessary capabilities to monitor, absorb and use it effectively (Cohen and Levinthal, 1990). In other words, domestic firms must have previously invested in the development of their own technical capabilities in order to be able to take advantage of the knowledge in the public domain. Otherwise they will not be able to reap the benefits of the technological knowledge introduced by MNCs.

Some empirical studies have provided support to this view (see for instance Kokko *et al* 1996; Koning, 1999; Girma, 2005; Girma and Gorg, 2007; Chudnovsky, Lopez and Rosi, 2008). However, there is also a large number of studies which has failed to support this view (see for instance Haskel, Pereira and Slaughter, 2002; Blomstrom and Wolf, 1994; Patibandla and Sanyal, 2005; Haddad and Harrison, 1993; Sjöholm, 1999; Chuang and

Lin 1999; Griffith Redding and Simpson, 2002; Castellani and Zanfei, 2003; Peri and Urban, 2006). Particularly interesting among these are studies finding inverse relationships between spillovers and domestic firms' capabilities to absorb them, because they are consistent with Findlay (1978) and Caves (1974) initial belief about the effect of the technology gap. In their view, the wider the technological disparity between foreign and domestic firms, the greater the opportunities for domestic firms to improve efficiency by imitating foreign technologies. Studies corroborating this last idea include Haskel, Pereira and Slaughter, (2002), Griffith Redding and Simpson (2002); Castellani and Zanfei, (2003) and Peri and Urban (2006).

From this empirical evidence it is difficult to glean a clear conclusion that the diffusion of superior knowledge from MNC would make a significant contribution to productivity growth of domestic firms – provided those firms had strong absorptive capabilities to capture the potentially available spillovers – independently of any other circumstance. A different kind of studies has concentrated on issues on the supply side.

2.3 Issues About the Supply Side: The Influence of Industry Differences and Corporate Strategy

A number of studies have raised questions about the '*supply side*' of the spillovers process. These have concentrated on two possible sources of diversity between MNCs in the scale of the spillovers they generate in host economies: (a) the differing characteristics of the industries in which MNCs operate, and (b) differences in the type and level of technologies transferred by corporations as a result of their centrally driven strategies. It has been argued that these two factors, often interacting, may influence both the technological behaviour of MNCs (eg, the types of technology they transfer to subsidiaries) and the scale of subsequent spillovers.

Differences between the technological characteristics of industries have been thought particularly important in influencing the scope for technology spillovers. Industries are

presumed to develop and use different levels of technological knowledge and to possess different levels of technological opportunity. Consequently they are presumed to offer inherently different potentials for generating technology spillovers. So, for instance, some types of ‘advanced’ industries, such as the electronics or capital goods industries, are thought to possess greater potential for generating spillovers because they conduct more R&D, use more recent vintages of technology, employ greater numbers of skilled workers, etc. In contrast, more ‘traditional’ industries are presumed to provide less potential for generating spillovers because they are, in general, less technology-intensive¹³.

However, other factors may cut across differences between such broad types of industry. This is partly because industries themselves incorporate considerable technological diversity – more and less advanced technologies for given types of activity in an industry, as well as more and less knowledge-intensive activities at different stages of the value chain. MNC strategies may thus interact with this diversity in ways that result in different patterns of technological behaviour across differing local circumstances. For example, even in more technology-intensive industries, MNCs may decide to locate in a host economy only the less value-adding or more labour-intensive activities. This might result, it is argued, in less technology transfer from headquarters and the use of less novel technologies – providing less opportunity for technology spillovers. FDI leading to such limited transfer-based potential for spillover in apparently ‘technology-intensive’ industries might arise, for instance, from corporate decisions to undertake only the simplest downstream activities needed to satisfy local markets.

For instance, concerned with the degree and quality of technology transfer by MNCs Wang and Blomstrom (1992) developed a model in which international technology transfer emerges from parent company decisions in the light of expected strategic interaction between their foreign subsidiaries and the technological characteristics of host

¹³ It is important to notice here that these approaches refer to differences between very broadly defined types of industry, as in the examples in the text above, industries defined as 2-digits (electronic or textiles) or even with higher levels of aggregation such as high or low tech kind of industries according to the OECD classification.

country firms. The main conclusion they reach is that the speed of transfer, and the vintage of the technologies transferred, depends on the actions and capabilities of local firms. This arises because the higher the host country firms' investment in learning, the narrower is the future technology gap facing the MNC. In response to this the MNC investor will transfer more advanced technology in order to ensure profitability in the face of more technologically capable competition. Thus, as with the absorptive capability models, the technological abilities of local firms are seen as an important influence on spillovers – but via their effect on the international transfer step rather than the subsequent step of capturing the transferred knowledge.

Ramachandran (1993) and Braconier et al (2001) have highlighted other possible causes for such variability in the intensity and content of technology transferred through FDI, and hence also, in principle, in the potential for subsequent spillovers from FDI. They have associated the extent and speed of international technology transfer via FDI with the mode of entry of MNCs. Ramachandran (1993) proposed that the use of majority ownership increases the likelihood of spillovers relative to minority ownership because implies the transfer of more advanced technologies. Braconier et al (2001) propose that the corporate decision of entry via greenfields is more likely to benefit the host economy via spillovers than the decision to entry via mergers and acquisitions. This is because in the first case the introduction of superior technology will be instantaneous, however in the second will be gradually, restricting or at least delaying the possibility of spillovers.

Finally, under the same top-down perspective Driffield and Love (2002, 2007) and Girma (2005) argue that a limited transfer of technology and therefore of spillover effects would emerge in association with corporate decisions to undertake “technology sourcing” rather than the traditional “technology exploiting” FDI. MNCs “*without advantages*” (Girma, 2005), which invest abroad to source technology rather than to exploit their superior technology are less likely to generate external effects: First, because they will have less to offer, and second because they will be less likely to introduce competitive pressures on domestic firms to improve their productivity it is argued.

These various views about sources of variability on the supply side of the spillover process discussed in this section have one limitation. They leave the centrally driven model of spillover generation via the technology transfer process intact. Variability is seen as arising because of the influence of various factors on centralised decision-making in the MNC; and that central decision making is about the international transfer step in the process – about how much of which kinds of centrally created technology to transfer to subsidiaries, and how rapidly. When the corporation has the right incentives – certain domestic conditions – it will transfer the superior or more advanced technological knowledge to the host country. Possible problems with the transfer in itself or the influence of subsidiaries' own activities are not considered. Those subsidiaries continue to play a passive role in the process – merely acting as a leaky, late-stage section of the conduit between knowledge-creation in the parent company and its absorption (or not) by domestic firms in the host economy. This view contradicts recent theorizing from the International Business literature which provides a much more active role to subsidiaries' own technological activities in the host country within 'models' of knowledge creation and diffusion within MNCs. It also contradicts recent evidence from the spillovers literature which has demonstrated that the local technological activities of subsidiaries are key in the explanation of whether spillovers take place or not. These views and evidence are incorporated in the model of spillover generation proposed in the next section.

3. An Alternative Perspective: A subsidiary centred model of FDI- related spillovers

An alternative to understanding what drives technological effects in association with MNCs operations is to focus on subsidiaries' own technological activities in the host economy, as the main drivers of technological spillovers. Those activities may be crucial to understanding the process of spillovers generation in association with FDI for two reasons. The first is that subsidiaries' own technological activities may contribute to the absorptive capacity of the subsidiary with respect to the technology transferred from the parent; so increasing the potential of spillovers in association with knowledge by the

MNC network in other locations rather than the host country of the subsidiary. The second is that, those localised technological activities of subsidiaries can become the source of more original technological knowledge, which can then spillover to domestic firms. Recent empirical evidence is confirming this presumption.

3.1 Localized knowledge activities of subsidiaries, absorptive capability and spillover effects

As discussed earlier implicit in much of the spillovers literature FDI is the assumption that knowledge is a kind of 'public good' within MNCs, i.e. that can be easily moved across different departments and branches within the MNC, or from headquarters to local subsidiaries. Several studies within the international business (IB) however, have demonstrated that this supposition is unrealistic (Teece, 1977; Szulansky, 1996; Gupta and Govindarajan, 2001). They all have shown that subsidiaries' absorptive capabilities play a key role in assuring the effective transfer of knowledge within MNCs. In a very early study Teece (1977), for instance, explored 26 technology transfer projects within MNCs and, demonstrated that the cost of technology transfer could reach as much as 59 percent of the total cost of transferring a project to a foreign country, and that the technological capacity of the recipient unit is a key factor in facilitating the transfer. Later on, pointing to the same direction, Ngho (1994) and Lim (1991) showed that subsidiaries in the electronic sector in Malaysia struggled for many years and invest heavily in human resources to be able to absorb technology transferred from the parents (quoted by Hobday and Rush, 2007). Similar results were identified by Szulansky (1996), Gupta and Govindarajan (2000) and Minbaeva, Pedersen, Bjorkman, Fey and Park (2003), who identified that the main barrier to internal knowledge transfer within MNCs was the recipient unit's lack (or inadequacy) of knowledge.

In line with this evidence it can be argued that the knowledge activity of subsidiaries in the host economy will be a key determinant in the explanation of whether FDI-related spillovers take place or not. This is because they will affect the capacity of subsidiaries to absorb the superior technological resources supposedly available within MNCs, if they

are. So, only technologically active subsidiaries, which invest resources in the development of their own absorptive capabilities in the host economy, will be able to diffuse superior technologies to domestic firms¹⁴. On the contrary, technologically passive subsidiaries, will be less likely to generate spillover effects. This is because they will not be able to effectively absorb the superior technological resources in theory available for them within their MNC network.

3.2 Localised innovative activity of subsidiaries, local innovation and spillover effects

The international business literature has also emphasised the increasingly important role of subsidiaries' localised technological activities for *knowledge creation* within MNCs (Cantwell, 1995, Kummermele, 1999).

In the early MNC literature knowledge activities in subsidiaries were typically presumed to be adaptive adjuncts to the transfer of technology from parents, especially so in the case of MNC affiliates in developing countries (Lall, 1979). Things have changed substantially, however, during the last three decades or so, and the literature has, by and large, reflected those changes. The diffusion of new technologies and organisational arrangements, and deep changes in world competition, has seriously affected the possibilities for international firms to look for, monitor, create and exploit advantages. Managers of MNCs nowadays enjoy an unprecedented degree of flexibility in moving production around, and in transferring know-how and knowledge from one location to other (Kogut, 2002). They have therefore started to become aware of, and sometimes make use of, the knowledge that exists in host economies (Cantwell, 1995, 2000), as well as exploiting system or cross-border advantages, which derive by virtue of the multinationality of the firm itself (Kogut, 2002; Hedlund, 1986; Dunning, 1994; Cantwell and Sanna-Randaccio, 1993). In the words of Hedlund (1986) international business has

¹⁴ The term 'technological activity' is used here in a broad sense to relate to any activity concerned with acquiring, accumulating or creating knowledge in subsidiaries. Within that, particular emphasis is placed on the importance of 'innovative' activity – again interpreted broadly in the mode of the Oslo Manual (1997) to encompass novel local knowledge creation.

become about “*actively seeking advantages originating in the global spread of the firm*” rather than just exploiting centrally created technological assets.

The early MNC models, as a centrally directed and closely integrated organisation, have therefore lost relevance, and, instead, much more flexible approaches have gained importance. These recognise wide-ranging heterogeneity between MNCs, along with varying forms of organisational flexibility and internal heterogeneity in the roles of subsidiaries and their relationships with parents and other affiliates. One example of this more flexible approach is the network-based view of the MNC introduced by Ghoshal and Bartlett (1990). This view conceptualises the MNC as a differentiated network of dispersed operations, with a configuration of activities and resources not fully controlled through hierarchical decisions taken by headquarters (Prahalad and Doz, 1981). Furthermore, within such a network each unit is recognised to be unique and is provided with a potentially important role in the process of advantage creation and circulation.

Alongside these changes has emerged a large body of research focusing on subsidiaries as an interesting object of study, ie, for understanding, for instance, knowledge creation within MNCs. “*The management of multinational subsidiaries has gradually emerged as a distinct field of research*” (Paterson and Brock, 2002, p139). This research recognises that subsidiaries can grow in size and importance and that many of them, drawing on their unique capacities and contextual resources, can develop a stock of distinctive assets on which the rest of the corporation starts to be dependent (Birkinshaw and Hood, 1998). Furthermore, it is increasingly emphasised that the development of those unique resources in subsidiaries may not always depend exclusively on headquarters decisions (Birkinshaw and Hood, 1998). Instead, subsidiaries may themselves actively engage in the attraction of capacities and resources from the rest of the corporation, as well as in the development of their own technological capabilities. All this suggests that subsidiaries' own activities may be important in creating technologies within MNCs.

In line with these ideas it can be argued that only those subsidiaries that are technologically active in the host economy, i.e. that invest and engage resources in the development of their

own technological capacity in the host economy via R&D, the employment of highly skilled personnel and/or investments in capital goods, would have more potential to generate spillovers. This is because they would have more valuable knowledge to spread, via demonstration effects, linkages with suppliers or the movement of personnel. On the contrary, passive subsidiaries, those that invest less in developing and using their own new technological knowledge will have less valuable knowledge to diffuse to domestic firms, and therefore will be less likely to generate positive spillover effects.

3.3 Putting subsidiaries at the centre of the process of spillovers: new merging empirical evidence

These ideas have been initially explored in works by Todo and Miyamoto (2002) with respect to Indonesia; and Castellani and Zanfei (2005) using data for Italy. Both studies found that spillovers from MNE subsidiaries' operations were strongly associated with the intensity and type of technological activity of subsidiaries in the host country – human resource training and R&D in the case of Todo and Miyamoto; and R&D intensity, co-operation with local counterparts, and duration of establishment in the case of Castellani and Zanfei.

These approaches to the estimation of spillovers have been most fully developed in Marin's work in Latin America and Asia. In particular, in Argentina, she found first that that FDI-related technological spillovers *did not* occur under the three more commonly explored models of spillover effects: (a) the '*Pipeline Model*', where spillover effects are supposed to arise from FDI in general independently of any other circumstance or mediating effect; (b) the '*Absorptive Capability*' model, where spillover effects are expected to depend on the capabilities of domestic firms; and (c) the '*Industry Model*', where spillovers are expected to arise only in more 'advanced' industries, such as the electronics or capital goods industries. Instead, spillover effects emerged *only* in association with the existence of specific types of knowledge-creation activities undertaken by local subsidiaries in the host economy. In particular, she

found that positive and significant effects emerged only in association with high investments in disembodied knowledge and human capital by subsidiaries in the host economy (e.g. local training and R&D activities), high levels of skill intensity, and other investments in disembodied technologies. In contrast, the effects were less significant in association with MNE investments in capital goods, confirming the view that the knowledge embodied in such assets is probably very 'sticky'. (Marin, 2006; Marin and Bell, 2006)

Similar results were obtained by Marin and Sasidharan (2006) and Marin and Costa (2008) in India and Brazil. First, FDI-related spillovers only occurred in India and Brazil when subsidiaries were technologically active. Second, spillovers were associated with relatively large investments in disembodied knowledge and human capital by MNE subsidiaries but less so with investments in embodied knowledge.

Finally, Marin and Giuliani (2008) included an additional dimension of subsidiaries' heterogeneity in estimations of spillover effects in Argentina. They distinguished subsidiaries according to *the type of global linkages* they develop and then explored both analytically and empirically the spillover effects of the different types of subsidiaries. More specifically they classified subsidiaries in four types: (1) Globally Diversified (GDiv) that use both linkages with the MNE headquarters and other subsidiaries, and linkages with other international firms or institutions; (2) Globally Dependent (GDep) that are engaged in linkages only with the MNE headquarters or other subsidiaries of the corporation; (3) Globally Independent (GInd) that use linkages with other agents in international markets independent of the MNE group and, finally, (4) Globally Isolated (GIso) that do not use global linkages either with the MNE or with other agents. In their view Globally Diversified subsidiaries are the type that is more likely to generate spillover effects because they are more likely to be both more innovative and entrepreneurial to develop local linkages, which are both more technologically intensive in the host economy and more entrepreneurial are more likely to develop knowledge linkages and spillover effects in the host economy. Their results confirm this idea.

All this evidence points to the potential importance of changing the focus on studies about FDI-related spillovers from technology transfer supposedly to come automatically associated with FDI to subsidiaries' own technological activities in host economies, and the drivers of these activities. This change in focus has important implications for research, because it opens up a new set of research questions up to now largely unexplored in the literature about FDI and innovation in developing countries. It also has important policy implications. In the next section I conclude the paper discussing these two set of implications.

4. Implications for future research and policy

This paper examined the dominant views about the mechanisms underlying FDI-related spillover effects in industrialising countries. It showed that the conventional views have systematically adopted a *pipeline perspective* of the process of spillovers generation and that this perspective: (1) does not take into account recent theorising from MNC literature about how MNC actually operate nowadays and, 2) has failed to explain the existence/absence of spillover effects. The paper then proposed an alternative view. This alternative drawing on recent MNC theory focuses on the role of subsidiaries' own technological behaviour. I refer to this as a '*subsidiary driven*' model of spillover effects. Finally, it discussed a recent body of empirical evidence which suggest that this alternative might be a more adequate framework to explain the process of spillover generation.

There are a number of important theoretical and policy implications of this new way of conceptualizing spillover effects. In particular three are worthwhile to discuss here.

First, it highlights the importance of focusing on subsidiaries as the main drivers of technological effects in association with MNC operations not only in FDI spillover studies but also more in general in studies concerned with the interaction between MNCs and innovation systems in developing countries, which all adopt in general a 'pipeline/centrally driven model' of the MNC ignoring the role of subsidiaries and local

initiatives in the process. These include case study material about MNCs linkages in host economies (see for instance Ivarsson and Alvstam, 2005; Zhou and Xin, 2003), studies about FDI-related policy (Mortimore and Vergara 2007; Oman, 2000), and studies about innovation systems that might be expected to address issues about FDI (Chesnais, F., 1993, Carlsson, 2005), among others.

Second, this model points to the importance of understanding the reasons for variability in the technological activity or innovativeness of subsidiaries in developing countries. Innovative activity in subsidiaries in advanced contexts has been extensively researched in association with the more flexible approaches of the MNC discussed in section three. However the literature has just very recently started to explore innovation and reasons for variability of innovation in subsidiaries in less advanced context (Ariffin and Bell, 2000; Ariffin and Figueiredo, 2006; Consoni and Cuadros, 2006, Marin and Bell, 2006, Marin and Giuliani, 2006). This emerging literature has provided a collection of partial insights about the degree, nature and determinants of innovative activity in subsidiaries in developing countries. For instance it is clear from this literature that some MNE subsidiaries in developing countries are located at 'highly innovative' and technologically 'active' positions while others are technologically 'passive' – i.e. widespread heterogeneity is important. It is also clear that over time subsidiaries may change their position on that spectrum, moving to the highly innovative position. However, there remains very little understanding about which are the key dimensions driving these movements, for instance how much the manager's initiatives can affect this process in industrialising countries, which is the role played by the MNC's governance mode, the role of policy, etc.. In consequence much more research is necessary to help to understand when and how subsidiaries can become innovative when they are localised in industrialising countries.

Third, this model raises questions about the effectiveness of costly policies that, justified largely in terms of the spillovers to be achieved, seek simply to attract FDI regardless of the innovative activities that are likely to be undertaken by the subsidiaries that are established. It also questions the very well spread view within studies on FDI-related

policy which insists in “attracting good quality FDI” as the only policy tool to extract benefits from MNEs. Within these views “good quality FDI” is supposed to be the FDI in technologically intensive industries such as pharmaceuticals or electronics or the FDI oriented to create R&D facilities. Thus, to attract this type of FDI the more common recommended strategy is to create local conditions favourable to developing and exchanging technological knowledge, such as raising education levels, supporting the science base, subsidising local firms' research and development (R&D) activities and protecting intellectual property rights. This is thought to, among other things, increase domestic firms' ability to absorb superior technology from MNEs, as well as to encourage MNEs to transfer more valuable technologies to developing country subsidiaries (see for instance Lall and Narula, 2006; Criscuolo and Narula, 2004; Mowery and Oxley, 1995). Another recommended strategy is to target winners, i.e. MNEs and projects compatible with the region (see Mortimore and Vergara, 2007).

The ideas and empirical evidence discussed in this paper question this kind of approach. It was suggested that what is important for spillovers to take place is not so much how much or of what kind of FDI to attract. Instead, what matters much more is what subsidiaries *actually do* once they have been established or acquired – namely whether they are entrepreneurial and innovative enough to contribute to the host economy in a constructive way. Consequently, there may be significant, but so far largely untried, opportunities for developing countries to design policies that can influence subsidiaries' technological and innovative behaviour, thus encouraging spillovers into the domestic economy. There are fragments of evidence as to what kinds of policies might be effective, however our understanding remains limited about possibilities of policy on this area. More research needs to be conducted to identify different options and their effectiveness.

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